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Risk factors in ERP project

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The purpose of this study is to explore previous researchers related to risk factors in enterprise resource planning (ERP) system implementation. With an aim to reach a coherent picture of risk related to the ERP project success. ERP systems have emerged to be the backbone of the infrastructure spine of several companies, thus providing valuable information to managers to enchase their decision-making and create competitive advantage. Even though the topic of ERP implementation output is a well researched, the success rate of the projects remains low, justifying the relevance of this research subject.

The key findings of this thesis are that top management support and commitment are essential to the success of ERP project, especially in the implementation stage of ERP's lifecycle. Top management supports meaning to the ERP project outcome was discovered by conducting a summary of studies exploring instances of critical success factors (CSFs) in literature. Lack of empirical studies concerning to the top management support and tools to monitor top management support during ERP project was recognized. Therefore, this thesis suggests further research should be guided towards a practical aspect of top management support since it is tightly related to ERP project outcome.

Keywords	Enterprise resource planning system, Risk management, Critical success factors.

Contents

List of Tables

List of Figures

1 Introduction

In today's volatile business world, companies face an exponential growth of data and fast changes in the economy. To cope with these conditions organizations seek solutions to increase their capabilities to adapt their business process to these quick changes to ensure their survival. Amount of data and requirements to handle it in an organization are much higher than a decade ago, information needs to flow smoothly to upstream and downwards inside the organization. For this dilemma Enterprise resource planning (ERP) system has proven to be a solution (Ali and Miller 2017:666). For that reason, ERP systems are becoming ubiquitous in large organizations, and even small and medium-sized organizations are considering implementing them to survive today's tough competitive world and even in the hope of receiving competitive advantage via automation and information flow.

ERP project is seen as one of the most time-consuming, most expensive and the most challenging IT-project that organization can take on. According to Panorama Consulting's yearly study companies spend on average over a year on implementing an ERP system (Panorama Consulting Solutions 2018:25). Even the long period of time spend on ERP project does not guarantee success since Garg and Garg (2013:498) identify from their literature study that 90 % of ERP system implementations are over budget or late, and the overall success rate is 33%. Žabjek, Kovačič and Indihar Štemberger (2009:588) agrees to the same 90% failure rate. Chang, Cheung, Cheng and Yeung (2008:930) identifies more variety in the success rate assessing that the rate is approximately 60-90%. When interpreting these finding, it is clear that ERP project is a more likely to fail than succeed. Why companies then implement ERP system as there is a huge possibility to fail? ERP system can yield significant benefits, e.g., reduced inventory, better financial management and reporting, reduced transportation costs and overall better information fluctuation, thus offering managers decision support which can lead achieving competitive advantage (Hamilton 2003). It is clear that an incomplete implementation of ERP system generates fewer benefits that have been expected in the beginning and it can even lead to several decreases in business efficiency (Pan, Baptista Nunes and Chao Peng 2011:108). For that reason, failure of ERP system implementation has been a popular study subject studied in the past.

The remaining low success rate reveals that the underlying root causes of ERP system implementation failure have not been satisfactorily revealed (Jagoda and Samaranayake 2017:92). Therefore, current practices need to be enhanced to reach better outcomes and therefore ERP project outcome is still eligible study subject. As the diversity and the implementation of ERP system depends on the users' needs and wants it is important to understand the concept of ERP system to understand the complexity and its effect on an organization. Thus, this research analyses the specific role played by ERP systems in organizations and tries to identify factors related to the success of implementation outcome by analyzing current literature. First, this thesis will review ERP systems as a concept and then discuss variables affecting ERP implementation success and finally, present practical tool to work with these variables.

2 Research approach

2.1 Research question and objectives

The objective of his thesis is achieving an understanding of ERP software and its meaning to the organization. Thus giving a coherent picture what is ERP, so that the thesis question can be answered: What are the risk factors affecting to ERP outcome? This research question naturally follows up to other reasonable questions that might be answered simultaneously or even need to answer before the actual thesis question can be answered: How the success of ERP system is recognized, in the literature? And what are the critical success factors of ERP project? By gathering more profound knowledge of those variables that have the most significant impact of ERP project outcome, better insights of the most significant risks for the success of ERP project are understood, and a probability of reaching an understanding to the research question is increased.

2.2 The methodology of data collection

This thesis is exploratory research as it focuses on studying a problem and to reach an understanding of different variables concerning the problem. Typical characters of exploratory research are that is it flexible, and it can change as new data and insight to the subject appears (Saunders, Lewis and Thornhill 2014: 171). This could be described as a funnel approach when a broad question is asked, and the question will get

narrower as research proceeds because more and more insights are discovered. As the thesis question What are the Risk Factors affecting to ERP outcome? Is broad, exploratory research methodology is suitable to gain more information on the subject and assess ERP project from a different perspective.

For data collection, this thesis uses secondary data, because as stated ERP systems are an integral part of modern business life and therefore widely researched and up-to-date. By secondary data, this research identifies raw data as well as compiled data to be useful for further investigation to gain a better understanding and different perspectives towards the research subject. To obtain secondary data is research focuses on relevant studies, journals, and books that are published via reliable party in a past few decades.

2.3 Scopes and limitations

As this research study will be conducted by using literature instead of using a specific case study, it is not limited to a particular industry or a region. Data about bigger organizations are tried to recognize, as their implementation processes are not as straightforward as smaller companies thus giving a broader scope of variables affecting possible failure. The only limitation of the scope is that this research focuses on ERP project in a private sector as the ERP. Implementation can be different in the public sector. Even though both of them faces similar obstacles and have similar goals, theories and thoughts in this research may not directly be applied to the public sector. As public sector can be more complicated and have procedures as well as legislation that does not apply to the private sector.

Another limitation might be that there is a lack of research material in unsuccessful projects because companies hesitate to expose and give details about their failed projects (Zabjek et al. 2009:590). Which is not surprising at all since this kind of sensitive information may give public too much internal information and reveal company's frailties. This could influence why implementation failure rates are steep as they are, as companies are reluctant to give information to researchers. This might affect to thesis outcome since there might not bee enough quality data to be analyzed. Also as this research is conducted by using exploratory research approach it does not focus on giving a definite answer, it focuses on gathering more information about the main subject. Therefore, this thesis might not offer one solid answer to the thesis question.

3 Enterprise resource planning system

Objectives and functions of ERP system needs to be understood, to define ERP's meaning to the organization and how its successful outcome can be defined. Thus, this chapter provides an introduction to enterprise resource planning- system, its functionalities and characteristics. ERP life cycle is also analyzed, and its relevance to this thesis is discussed.

3.1 Definition of ERP system

Oxford dictionary (2018) defines ERP systems as an integrated computer system to manage all information and resources in relation to company's operations. Other published authors share the same view of this concept, e.g., Gable (1998:3) describes ERP as a "comprehensive packaged software solution, which seeks to integrate the complete range of business processes and functions in order to present a holistic view of the business from a single information and IT architecture". Sullivan, Wyeth and Chumney (2006:3) also emphasizes the role of ERP system as a system that integrates all functions to give a holistic view of a company from a single IT system. Davenport (1998:124) illustrates these definitions in his anatomy of an enterprise system diagram (Figure 1).

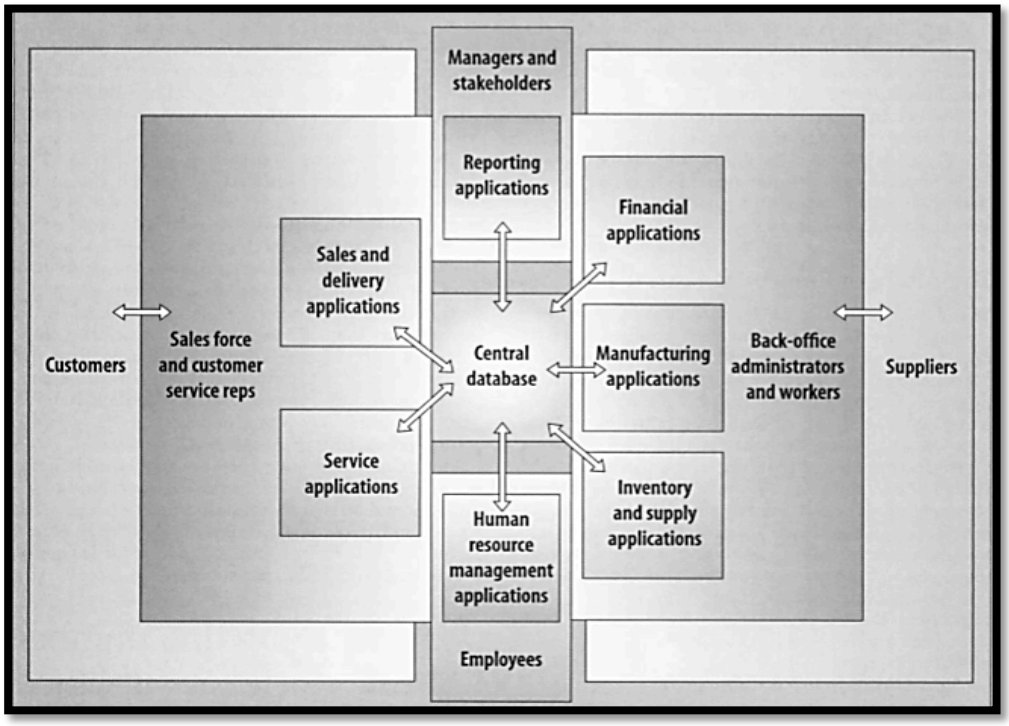

Figure 1: Anatomy of an enterprise system (Davenport, 1998:124)

As we can see from the figure 1 ERP systems are designed around a common database, this forms a fundamental principle of ERP system. Instead of several standalone databases, a single database is used that serves all users from the CEO to accounts receivables and production (Garg and Garg 2013:497). The use of the same database removes the possibility of duplicate entries and enables same data usage through different core processes simultaneously. As the same information is available to the front office as well as to back-office workers, it removes possible communication silos inside the organization. It also improves data quality as the data is managed concentrated it also offers transparency to master data. Such an information technology structure that allows data movement be very attractive to multinational organizations with several departments connected to the same database as the data fluctuations easily over country borders. This kind of IT architecture facilitates even external stakeholder like suppliers and customers. Usually, they are not part of the ERP software system, but the data fluctuation between these external stakeholders can be executed via electronic data interaction (EDI). By simplifying it can be said that ERP integrates company's core processes into one single system.

corporations

3.2 Evolution of ERP system

The root of the ERP system development can be traced back to the early inventory control (IS) system and bill of materials (BOM) processor in the 1950s and 1960s. Both of them focused more on a one functionality processing unlike basic ideology of ERP that has multiple functionalities processing simultaneously. Many authors agrees that ancestor of ERP system is material requirements system (MRP) that was developed in the 1970s, it focused more on to the production planning, inventory controller and to plan manufacturing activities (Helo, Anussornnitisarn and Phusavat 2008:1046; Parthasarathy 2007:9-11). MRP was planned to meet objectives of a typical manufacturing process therefore only applicable to manufacturing companies. Later on, in 1980's, MRP evolved to MRP II. MRPII aimed to optimize manufacturing process by integrating needs material with production requirements (Rashid, Hossain and Patrick 2002:4). It also expanded to other business functions and begun to serve all primary functions to business; manufacturing, marketing, shop floor management, and finance. (Parthasarathy 2007: 12)

In the beginning of 1990s as a logical technical extension based on the functionalities of MRP II, ERP system was created. The main difference between MRPII and ERP system is that ERP focuses to plan and schedule outside demands and resources as well, not only internal resources as MRP-II (Parthasarathy 2007:12). ERP integrates all business processes required in company's operations by providing information flow, accessibility, transparency and consistency across the organization. As organizations requirements kept growing ERP vendor started to add more and more modules and functionalities to ERP system as "add-ons" (Rashid et al. 2002:4). It could be said that from the beginning of 2000 an extended or ERP 2.0 started to take its place. Today's ERP program offers functionalities, e.g., for supply chain management and customer relationship management as well as to business intelligence where data can be exported from the system for further analysis and produce solid management reports. Creating the backbone of company's operations in every aspect.

3.3 ERP Market today

Due to the era of globalization and complex supply chains, there is no question about the importance of an information system for the organizations to efficiently manage their activities Helo et al. (2008: 1045). This is shown in the Panorama Consulting Solutions (2017) yearly ERP-market study were 81% of responded were either completed their ERP implementation or in the process of it. Chaudhari and Ghone (2015) also

supports it in Allied Market research by forecasting that the global market is expected to gain compound annual growth of 7,2% during the period 2014-2020.

According to Taylor (2017) current trend in ERP systems is the movement from on-premises to cloud-based. By the 2020 analysts forecasts that 40% of large companies will have at least 60% of their ERP in the cloud. Taylor (2017) also explains that the turnover for this direction is not about money or technology, it is about organizations strategy, e.g., to streamline their IT functions and increase flexibility and ensuring their competitiveness in a digital future. This future trend is also view is also supported by Panorama Consulting Solutions (2017) that also include interest from small and medium-sized enterprises towards ERP and the upcoming trend of transferring from on-site ERP system to cloud-based ERP system. Future forecasts indicates that the ERP market size keeps growing, meaning that organizations will implement to ERP system or update their old ones, the risk factors of this implementation process will be a relevant topic in the future.

3.4 ERP as a more than a computer system

ERP often rises as an association to a software system, but today it could also be interpreted as a business strategy. There is nothing new that every organization needs to form a strategy how to manage their business process, e.g., production and sales. However, today's business world requires fast response time to market fluctuation and to achieve that business software systems are stepping in and offering a possibility to real-time and fast data fluctuation around an organization. Today's ERP systems support the core business processes from production to human resource management by removing information silos thus allowing better communication and information sharing between different departments. Of course, ERP is not the only solution to organize business processes, but it is a popular way to link business process to achieve access to information in a real-time (Nah, Lau and Kuang, 2001:285).

Successful integration of ERP system to company's typical business actions, e.g., shipping and logistics to ERP system has a positive impact on the company, and it will inevitably improve competitiveness (Dezdar and Ainin, 2011:923). Data collected from all business units, e.g., manufacturing and sales are stored in one location, offering a

possibility to generate more comprehensive reports to management. Since several processes can be worked simultaneously, it gives an opportunity to real-time reports that enable management to make critical decision. It forms the infrastructure spine of many organizations and the importance and impact of ERP system to organization functionality and success plays a big part, even to company's competitive advantage as ERP systems typically have an impact to the entire organization (Davenport, 2000:110).

3.5 ERP as a competitive advantage creator

There are several ways how businesses can create competitive advantage, one of the ways to achieve competitive advantage traditionally is to add productivity. Ganesh, Mohapatra, Anbuudayasankar and Sivakumar (2014:11) states that ERP system can improve productivity in two ways. First, linking best practices to its modules thus achieving better efficiency for the existing processes. Second, retrieving suitable information for managers when it is needed to enable better critical decision-making. Management decision support can also create other possible ways to achieve competitive advantage. With a faster and correct data fluctuation better decisions can be made, e.g., stock levels can be adjusted to a minimal level which releases tied monetary resources that can be harness to other investments or possible new business adventures and that way achieve competitive advantage (Ravnikar 2010:186). Managing activities and information parallel enable companies to make quicker decisions regarding changes in the market, which as well offers opportunities to create competitive advantage (Ganesh et al. 2014:11).

Another resource to generate competitive advantage is automation, by automation activities, e.g., billing or warehouse management can be handled entirely or even partly automatically. This reduces the time of these processes and releases labor work. According to Hamilton (2003:37) manufacturing company may achieve even 10% reduction from the direct and indirect labor costs from a successful ERP implementation. Automation in accounting controls especially in trade receivables by enchasing credit checking simultaneously in sales order creation moment, offering timely customer statements and better transparency to customer accounts can lead reduction of outstanding receivables by 18 % (Hamilton 2003:38). All of these cost savings are directly visible in financial statements, in trade receivables, cost of sales and in inventory,

therefore showing a better picture of the company's financial position the external stakeholders.

3.6 ERP lifecycle

When an ERP system passes through a company, it has various stages from selection to retirement. All of these stages present different characteristics that are peculiar to the specific stage in question. To fully understand what ERP means to the company and what it requires during its life cycle current literature is being examined.

Two of the most adopted models in the literature about ERP system life-cycle is developed by Markus and Tanis(2000) and Esteves and Pastor (1999). Both of them describe similar phases in ERP software systems lifecycle. Esteves' and Pastor's (1999:3) ERP lifecycle framework provides more deep and versatile aspect to examine ERP lifecycle. Their model includes; adoption decision, acquisition, implementation, use and maintenance, evolution and retirement (Figure 2). Adaptation and acquisition involve identification of the need of the ERP system as well as evaluation and acquisition of suitable ERP software. Compared to Markus &Tanis (2000:189) that presents four phases; Chartering, Project, Shakedown and Onward&Upward phase lacking the retirement phase. Even though the name of this phases varies between authors, the characteristics and nature of these stages stay same.

Figure 2: ERP software lifecycle (Esteves and Pastor 1999:3)

Adoption decision is about recognizing the need for ERP system, and in acquisition stage, crucial decisions about ERP characteristics is made in an attempt to reach positive effect on business. These decisions are, e.g., which vendor to choose and how many business functions include in ERP system. Implementation phase includes testing and modification of ERP package to reach compatible with existing business processes. Use and maintenance include completing daily activities and maintaining ERP system, e.g., updates. For a final stage, Esteves and Pastor (1999) recognize evolution and retirement phase where old system is replaced by a newer version or model to

achieve better functionality. This lifecycle phase model does not differentiate from other IT systems lifecycle, therefore by itself it does not offer additional value for understanding the complexity of ERP system.

Esteves and Pastor's (1999:5) ERP life stage framework also identifies four dimensions, which through lifecycle should be analyzed; product, process, people and change management. These dimensional views embody different perspectives where the ERP lifecycle should be examined to fully understand its meaning to an organization. Product dimension focuses on the functionality of a particular ERP system and explains that understanding features of the system is critical to achieving successful alignment between business strategy and ERP system. Process dimension refers to the same viewpoint, as it emphasizes the importance of ERP to be suitable for organizations own core capabilities and to help decision making what is required to manage resources and functions. To reduce risk and to help facilitate organizational change Esteves and Pastor's (1999:5) lists people to be one of the dimensions. It refers to the people in the organization are the capabilities to roles in ERP life-cycle, and that adaptation to new organizational structure and practices must be learned. The last dimension is change management refers to the management body of the organization that they need to be ready for a complex change so that the organization can achieve benefits of ERP system.

By adding four different dimensions to the ERP lifecycle Esteves and Pastor (1999) paints a more comprehensive picture and explains its meaning to the organization deeper then Markus and Tanis (2000). These four dimensions also distinguish their framework model from other typical IT system life stages and connect ERP life cycle to the successfulness or ERP in the organization and what factors ERP system meets during its lifetime.

3.6.1 Most critical lifecycle stage

Like a chain reaction, it is clear that pre-implementation has an impact on the implementation phase, and they both have an effect on post-implementation phase (Pan et al. 2011:108). For instance, a decision made during implementation without seeing the whole picture may cause severe problems in the maintenance of ERP software in a post-implementation stage. Ali and Miller (2017: 682), names the pre-implementation phase as a "starting-point" where attitudes towards ERP project are formed, and they

will affect the upcoming implementation phases. Markus and Tanis (2000:190) stress out that the project phase in ERP lifecycle could be the most important for overall success as ERP system is then synchronized with existing business processes and testing is done. The importance of testing phase is proven by several companies who have gone live too quickly without having a sufficient testing period. Nike's decision to implement their ERP software that affected their global supply chain system without proper testing was one of the reasons that caused them to lose 100 million dollars in sales and depressed their stock price by 20 percent (Koch 2004).

Esteves and Pastor (1999:9) imply that implementation might be the most relevant stage by asking questions, e.g., "Will the system work properly, according to requirements? Will it be finished on time? Will it come in on a budget?" as answers to those questions rely on the implementation stage. Esteves and Pastor (1999:9) confirms this by explaining as implementation phase involves risk management where critical factor is analyzed, and the success vs. failure is examined. Davenport (2000:169) agrees to this by stating that implementation is the most difficult part in enterprise system project, therefore several organizations may lose their hope in the middle of implementation. He also points out that steps taking in implementation are critical to the ultimate value that can be reached from this project. Ali and Miller (2017:678) agrees to this by stating that "...implementation phase is the one most vulnerable to failure". Majority of authors agrees that the implementation is the most riskiest phase during ERP's lifetime. Thus, offering a view point where the ERP project success is determinate and organization focus and resources should be focused on that particular point in order to achieve wanted results.

3.7 Risk Management

All business activities involve various risks, especially when taking in a new investment project like ERP systems implementation. No company can act without accepting any risk, and the expected revenue from the business must be related to the risks involved. The task of risk management in ERP project is to identify the potential risks of ERP project concerning the company's goals and to eliminate or minimize them. The risk is defined as an impact of uncertainty on the company's original objectives and impact is considered to be a negative deviation from expected. These deviations can only be managed if they are identified and understood in advance (Slack, Brandon-Jones, and Johnston 2013:612). This thesis uses basics of risk management where the first step is

to identify the risk, and second is to assess the risk and third design solution to the risk (Figure 3).

Figure 3: Risk management phases (Adapted from Slack et al, 2013:612-634)

Usually, in risk management, the probability of the risk is calculated, as this thesis does not assess any particular case company the probability calculation could not be executed (Slack et al. 2013:622). Thus, this thesis only analysis risk based on the literature to assess their meaning to the organization.

4 Recognition of ERP project success

In recognition of ERP project success, the main question is how those organizational performance factors, e.g., decreased sales can be disentangled from ERP-implementation failure from a standard business fluctuation (Loo, Bots, Louwrink, Meeuwsen, Moorsel and Rozel 2013:104). Changes in the management team, new marketing campaigns, and other activities during implementation also affects the organizations' performance and their participation is not easy to assess. Implementation project may get a failure stamp due to organizational change even though the actual implementation of a new system is working perfectly. Also, changes in legislation can affect to the economic situation of the relevant market, this can cause interruptions in the market that deviates from its normal behavior and therefore set more challenges or give a natural boost to the organizations business. Overall changes in the market, e.g., sudden high demand from the market may test system capabilities during implementation and even cause false results in case system cannot perform in this exceptional situation.

There are as many reasons that may cause success or failure in ERP implementation there as there are perspectives how to interpret success. During research, it came clear that authors interpret success differently in a context of ERP project. Example vendor may look ERP project more from the technical perspective like has the implementation succeed in terms of a plan, thus assessing ERP project successful even though companies objectives may not be achieved and they stop using its system. Studying problems and outcomes of ERP projects Markus, Axline, Petrieand and Tanis (2000:246) defined perspectives how the success of ERP project can be assessed. In their study, they identified five different perspectives to examine success in ERP project (Figure 4).

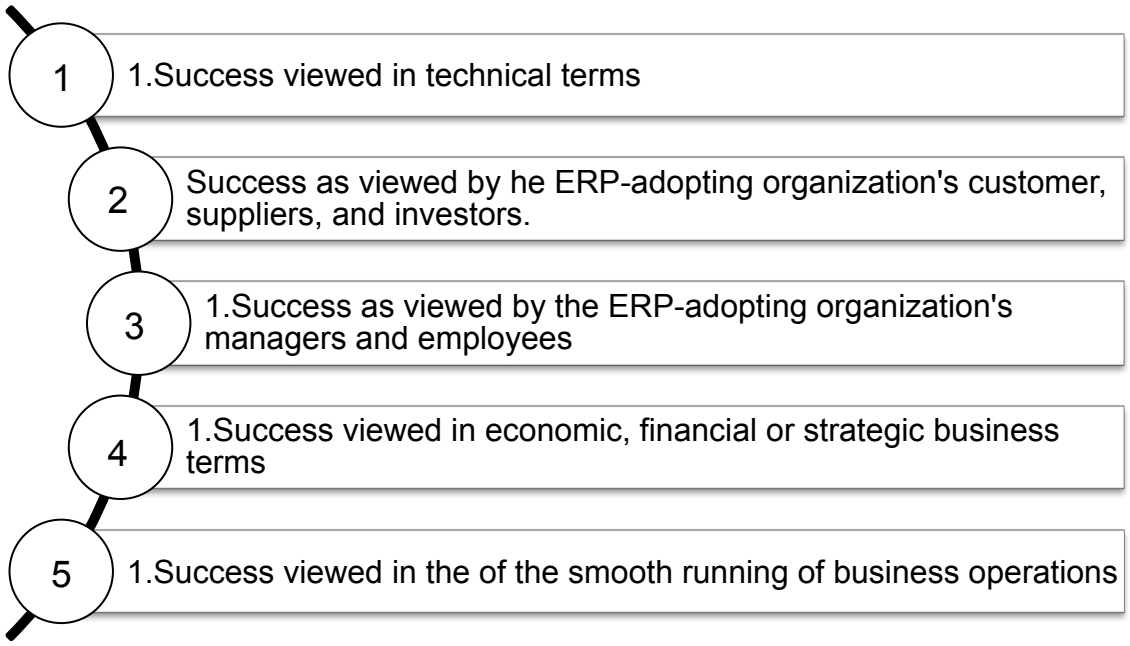

Figure 4: Five perspectives to view ERP success (Adapted from Markus et al.2000:246)

These perspectives describe evaluators and their priorities when they examine ERP project. Evaluators position in the ERP project may also affect what perspective he or she has towards the success of ERP project, as people are more keen to see that their participation has brought the success to the company. As the perspectives are shaped by evaluator's own mindset, values, and motives, e.g., monetary bonus there are numerous amount of perspectives not only those that Markus et al. (2000) presents. There is not any unambiguous perspective to assess success since it is impossible to normalize all sole objectives into one.

Also, the time of the assessment may give false results about ERP project output. Results of the ERP implementation may be visible after a while from implementation. Panorama Consulting Solutions (2018:31) yearly surveys revealed that organizations experienced realized benefits from 0 to 36 months after implementation majority (37% of respondents) experiencing benefits from 13 to18 months post-implementation. Since it may take some time to see benefits Zabjeck et al. (2009:603) points out that organizations should not resign or lost interest towards ERP project too soon or judge their ERP project as the targets set from the business perspectives may be visible after a year from implementation. Interaction failure can be visible from the beginning of EPR implementation, unlike correspondence failure that might be visible even a year after implementation. As criteria and Markus et al. (2000:264) identify that in a different ERP project life stages different measurements should be used and that outcomes measured in a particular phase affect loosely to following stage outcomes. They also present hypotheses that if problems are not resolved before the symptoms from these problems appear, it could be a possible reason for failure in ERP outcome. This has a reasonable sound as the problems and issues need to be solved before they multiply themselves.

In case of organizations, experiences adversities during the implementation Myreteg (2015:120) offers interesting theory where the misfortune is linked to organizational learning and therefore enabling an organization to gain for the failure. When the implementation is successful in a traditional scale, it creates only single loop since there is no need to rethink or adjust implementation in contrast to failed implementation which creates a double-loop as the project need to repeat, and an organization has an opportunity learn from mistakes. In this situation, the managers and users may feel that the project has been failed, even though from an organizational point of view it is not. Failure allows an organization to grown and find its strengths it may even create stronger organization than before implementation failure. This sums up that the ERP project outcome is dependent on how and by whom it is determined. For that reason, it is critical to choose yardstick and perspective that is important to the organization itself and focus more on the value bringing measurements instead of general project measurements to examine the success of ERP project. In literature to analyze has the ERP project been successful or failure theoretical frameworks have been created to help the assessment.

4.1 Tactics to recognize ERP success

One of the most typical measuring tactics is to assess ERP project via frameworks. They offer a possibility to examine different variables that may affect the overall successfulness. In current literature, ERP frameworks can be divided into two different categories, during implementation and post-implementation assessment.

Parr and Shanks (2000:290) identify three different phases in implementation process; planning, project, and enhancement. Al-Mashari and Al-Mudimigh (2003:354) also presents similar three stages taxonomy: setting-up, implementation, and evaluation. In the project phase more specific actions are recognized; set up, re-engineer, design, configuration & testing and installation. Where in the implementation phase several factors were included; ERP package selection, communication between organization and people, Process management, training and education, project management, legacy systems management, systems interaction, and cultural and structural changes.

Saade&Nijher (2016:88) identifies five different categories in their framework; organizational state, business requirements, technical solution, project implementation and post-implementation. It is clear that there are similarities between these frameworks, especially project implementation and after implementation phases/stages are repeated. Saade and Nijher (2016) focuses more on the planning phase when compared to the other authors. Previously described frameworks focus more on the planning and implementation process. Used to identify areas that need to be an improvement to needed levels.

These frameworks assess implementation from different perspectives and they emphasize different Framework mainly described different phases of implementation where to focus and insert resources. Ali and Miller (2017:684) points out that in current framework literature is missing two critical factors. One of them is the lack of industry-standard implementation framework is missing. This makes it difficult to assess different ERP projects by using a single framework that would comparable results and made a conclusion which of the project were successful. Most of the literature is also focused on planning and implementation phase, not post-implementation. This could be because companies are not willing to expose their difficulties to the public eye, the post-implementation assessment could be done only inside an organization, and therefore framework or data to execute studies are not available. This factor supports limitation

founded in connection with this thesis topic. As ERP has been a phenomenon of IT-projects and they need to be updated, modified and altered after initial implementation it is critical to have tools to access post-implementation access and possible needs for post-improvement and adaptation to organizational changes. This creates an opening for post-implementation framework also these frameworks itself does not offer detailed measurement to assess success, unlike CSFs that offers more practical and detailed ways to explore reasons for are tightly linked to frameworks, and they are concrete factors when deciding ERP implementation success, it natural to steer this research focus towards CSF. Ali and Miller (2017:673) sums up that the key to success of ERP implementation is to understand and address a variety of CSFs.

5 Root causes of ERP project outcome

The complexity of ERP project creates several pitfalls that organizations need to concur to achieve successful compilation. As the consequence of the failure might be devastating due to the extensive impact on the whole organization, it adds up the pressure to break down root causes that affect the ERP project outcome. Some failures are coincidental or they cannot be predicted, e.g., political fluctuations that difficult or even impossible to prevent them happening. However, a majority of common failures can be predicted according to Slack et al. (2013:613) identification of failure requires classifications and checklists of potential sources of risk. Aloini, Dulmin and Mininno (2007:552) classified ERP project success into four different categories to describe their reasons and effects in figure 5

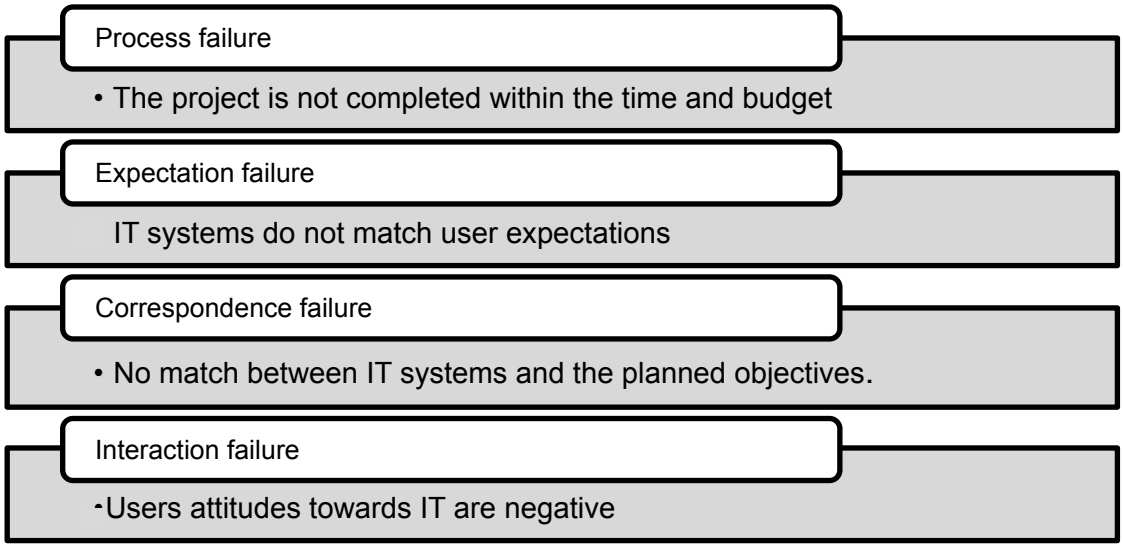

Figure 5: ERP failure categories (Adapted from Aloini et al.,2007:552)

This classification is an attempt to combine different interest levels into one category and find which influencers are behind each category. Process failure describes common project milestones regarding time and budget issues. ERP projects do not usually meet these typical project milestones, and therefore they do not offer reliable assessment criteria and process failure as a level does not bring knowledge to the ERP project assessment. Failure types set by Aloini et al. (2007:552) are not compatible with each other, as the failure in some category does not lead total failure. For example, even though the ERP project may overrun the initial budget, the ERP system itself can still work correctly along with the business process and bring value to organization unlike if the failure occurs according to category four. In case failure is that organization planned objectives and ERP system does not meet it could have a devastating outcome to the whole project as well as to the company.

Sometimes the failure might also be several small factors that together create a storm even though the preparation and experience towards ERP implementation have been at the top level. In 2004 Hewlett-Packard decided to move their most significant division onto their centralized ERP system. At first, they encountered some data modeling issues between an old and new system, even though these problems were solved rather quickly orders began to backlog leading to dissatisfied customers (CIO 2007). Due to their capabilities to handle the backlog in supply chain they lost approximately 40 million dollars in revenue. From this example case, we can see that the beginning of the problem were small data problems lead to problems in company's key business process were not predicted or prepared. A problem with this scenario is that the even though the risk of data management was realized its impact on the overall business were not adequately assess and prepared. Most of the companies prepares extra codes for problems in the ERP project instead of extra products, as creating extra products is more expensive then preparation for extra codes (CIO 2007). As there are nearly infinite combinations of small problems, it is nearly possible to adjust all of them to lack of resource in several organizations. Therefore, it is evitable to find the most critical factors affecting the ERP project success.

6 Critical Success Factors

"Critical success factors (CSFs) are those things that must be done correctly for a project to be successful; however, CSFs are not sufficient by themselves to guarantee success." (Van Scoter 2011:3) As CSFs describes factors that are need to be done in order to achieve success, they could also be interpreted as the biggest risks because if they are not executed properly they will have negative affect to the ERP project outcome. Van Scoter (2011) points out, CSFs are essential to the successfulness of ERP project, but not alone. Meaning that CSF needs to be identified, understood, measured and taken into account during ERP project. Identification of CSFs varies from implementation project to another manufacturing organizations appreciate and lists different aspects to its CSFs then a distribution organization, e.g., manufacturing company may emphasize production capabilities while distribution company's primary concern could be stock level management. Usually, common metrics to measure ERP implementation output are related to costs and timeline such as will the project stay on budget and time. This is due to that these are common factors that are used to assess output (Esteves, Pastor-Collado, and Casanovas 2002:1) As Garg and Garg (2013:498) pointed out ERP implementation projects are almost never on a budget or even on an initial timeline. For that reason when examining ERP implementation success in a traditional project metrics do not guarantee success. Because ERP project is not like other typical IT projects in the companies, other additional metrics should be developed and analyzed. As a result, it is difficult to have a standard set of CSFs, which would imply all companies then general milestones that are similar to all projects in an organization. Thus, this chapter focuses to explore different CSFs as a single variable without attachment to any industry as well as a concrete way to assess the success of ERP project and deepen our knowledge for the essential CSF to reach an understanding its meaning to an organization.

6.1 Frequency analysis

Critical success factors are one of the most explored areas in the ERP literature. With the help of existing literature, this chapter investigates most essential CSFs by examining studies that have investigated CSF instances in literature. Combining different studies that have had similar methods and goals this frequency analysis is trying to identify the most relevant CSF for further investigation.

Reviewing 70 articles Finney and Corbett (2007) picked out 45 applicable ones to their research. In total, they formed 26 different categories of CSFs and counted how many times different categories were mentioned in the applicable articles (Appendix 1). In

over half of the literature top management commitment and support, and change management were mentioned table 1. As seen change management appears as one of the most cited critical successful factors, the content what change management includes in relation to ERP is vague Finney and Corbett (2007:342). Their study noticed that tactics to handle change management were not identified and explained enough in current literature. Therefore, a gap of change management literature from the ERP project success perspective is something to be needed to be explored more. Finney's and Corbett's study offers a solid base for a literature study even though they only examined 45 sources in their study.

Table 1: Top 5 CSF from Finney and Corbett (2007) study

Critical Success Factor	**Number of instances in literature**	**Rank#**
Top management commitment and support	25	1
Change management	25	2
BPR and software configuration	23	3
Training and job redesign	23	4
Project team: the best and brightest	21	5

Leyh and Crenze (2013), performed CSF comparison between ERP systems and IT projects. They investigated in total 241 papers, which 185 addressed directly ERP system success which this frequency analysis uses as they are directly related to ERP success and are comparable with other studies. In total 31 different CSFs were recognized (Appendix 2). Top management support and involvement were cited in over 69% of the literature used in their study (Table 2). This gives strong indications that the top management support and involvement could be the most important CSF. A few years later Leyh (2016) conducted another study about Critical Success Factors. This time he conducted and updated previous systematic literature review from the perspective of small and medium-sized enterprises (SME) and their similarities and differences with larger enterprises. In altogether 320 papers were identified that referred to CSF and 31 variables influencing the success of ERP project were identified (Appendix 3). Again, among larger enterprises, same CSFs were mostly cited, top management support was cited in 63% of all the literature (Table 3).

Table 2: Top 5 CSF from Leyh and Crenze (2013) study

Critical Success Factor	Number of instances in literature	Rank#
Top management support and involvement	128	1
Project management	104	2
User training	99	3
Change management	86	4
Balanced project team	85	5

Table 3: Top 5 CSF from Leyh (2016) study

Critical Success Factor	Number of instances in literature	Rank#
Top management support	202	1
Project management	172	2
User training	167	3
Change management	143	4
Balanced project team	141	5

Top management support and change management were also revealed to be most cited in Zabjek et al. (2009:603) study (Appendix 4). They verified their results by combining results to their study which provided practical implications that same results from the literature were accurate also from the practical side. Even though their literature review resulted Top management support to be most crucial CSF (Table 4). Zabjek et al. (2009:598) chooses to give particular emphasis on business process engineering as they feel that the key for successful ERP project is aligning existing processes to within the processes implemented. Zabjek et al. (2009:592-593) raises an interesting question about the literature aspect of their study. They notified that in the literature there were not necessary a mention how did the original author emphases the importance of particular CSF. Thus this can create an inconsistency in the interpretation of CSF importance. This also applies to other studies that have formed their data by examining literature and counting instances in there. Even though the single author may not have prioritized CSF same levels as the frequency analysis, the CSF in question has still risen as a topic point in several studies and articles thus emphasizing its meaning and relevance to the ERP implementation output.

Table 4: Top 5 CSF from Zabjek et al.(2009) study

Critical Success Factor	Number of instances in literature	Rank#
Top management support	20	1
Change management	16	2
Clear Goals and objectives	13	3
User training and education	13	4
Project team organization and competence	13	5

Shaul and Tauber (2013:55:11) identified over 94 CSFs by going through 341 articles concerning about empirical studies that were found to be relevant to ERP categorized found CSF to 15 general categories and placed these 94 CSFs as subfactors beneath main categories (Appendix 5). Again, support from top management rose to be most cited CSF in literature (Table 5). Their research also postulated causes behind these variables; standard ERP packages are designed to increase data fluctuation and standardize companies' policies, they might not be sui for nonhierarchical companies. ERP resonate with a majority of organization managers failed attempt to engage personnel to the changes will lead unsuccessful outcome of ERP project. Shaul and Tauber (2013:55:11)

Table 5: Top 5 CSF from Shaul and Tauber (2013) study

Critical Success Factor	Number of instances in literature	Rank#
Support of top management	73	1
Implementation strategy	71	2
Project management	70	3
Enterprise system	58	4
Project team competence	55	5

6.1.1 Discussion

There is no denying that the selection of suitable ERP software system is critical as the poor selection will have an effect to latter stager in ERP project as (Garg and Garg 2013:499) states. However as we can see from tables 1-5 most of the CSFs related to ERP implementation output are more organizational nature then technological, only Shaul and Tauber (2013) mentions enterprise system itself to be a critical factor. Usually, IT projects including ERP projects have been seen more technological and the approach to ERP project may begin from the technological perspective even though several studies show that the success is more dependent on the organizational factors. Davenport (2000:203) supports this by stating that the if ERP project s treated as a technology project rather then an organizational project it is a mistake.

In total this frequency analysis combined 913 articles from different studies, most cited CSFs were top management support, project management, project team, user training and change management (Appendix 6). Some of the studies explored in this paper may have used similar articles as a data source. Therefore, the result of the study may not be precisely accurate, but it gives strong indication that the management has a vital role in ERP project success. Figure 6, shows that the top management support was cited in almost half of the literature reviewed, only pure technical CSF was enterprise system which were cited in only 6 % of literature.

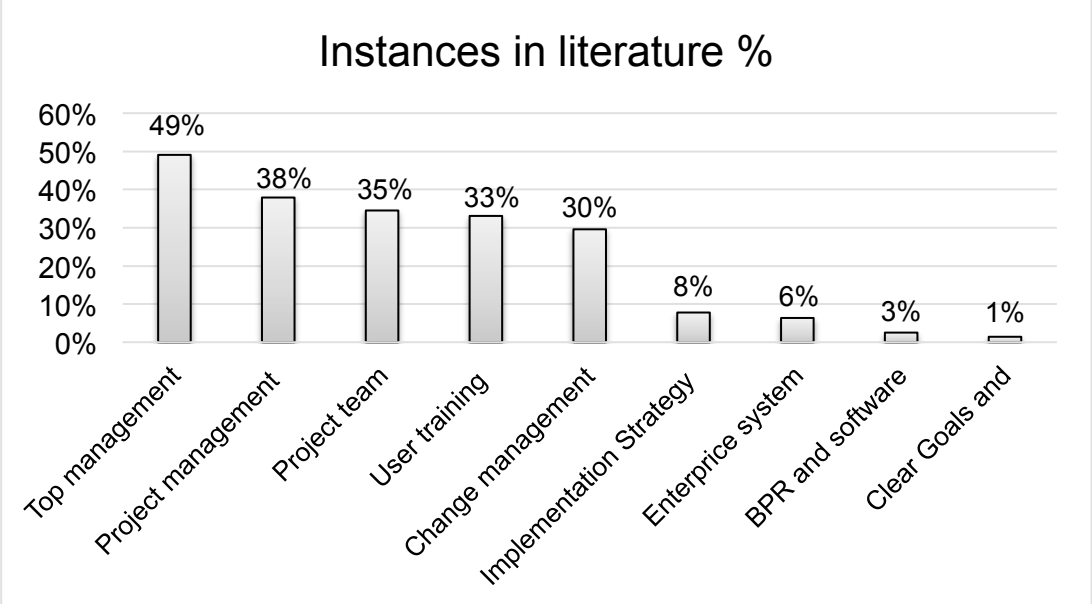

Figure 6: CSF instances in literature

Change management was also listed often and several authors, e.g., Zabjek et al. (2009) emphasizes its meaning to ERP project even though it might not have reached

the highest frequency. With top management, a project team was also noticed by all of the studies. Also, authors that did not conduct a systematic literature review based on the instances in the literature found that top management team support and good project teams were most essential CSFs for achieving successful implementations Ali and Miller (2017:683-684) In general, authors identified similarly in CSFs among their studies and most of the variables were connected to each other, and especially Top management support could be seen as an umbrella term since most of the CSFs identified needs top management support.

Not all researchers share the same view about the importance of CSFs for project success. Ağaoğlu, Yurtkoru and Ekmekçi (2015:40) founds that vendor support, careful selection of ERP software and software analysis, testing and troubleshooting are variables that explain ERP project outcome. In their study, they did not find significant linkage between ERP project success and CSFs. Some authors also describe CSFs as a laundry list of information, were items on list are only executed but not monitored and assimilated. Although the criticism towards CSF majority of authors sees that CSF reflects those key areas that organization must achieve favorable results in order for a business to compete successfully, for that reason they must give special attention that continues to bring high-performance results Ali and Miller (2017:673). As managers have a decisive impact on the critical success factors and therefore a direct impact on the ERP project outcome, the success of ERP project outcome is thus dependent on CSFs (Ravnikar 2010:88). As a conclusion if top management support has a significant impact as it has according to the frequency analysis it inevitably has a decisive impact on the overall outcome or ERP project.

6.2 Top Management support

When the critical success factor is well-known the higher is the success rate of ERP project (Ravnikar 2010:187). As discovered in the previous chapter of frequency analysis, several current pieces of literature have identified top management support to be one of the most critical factors in the success of ERP adaptation. Therefore, this chapter focuses on seeing ERP project from a management point of view and tries to identify top management support and commitment variables where managers have a crucial role in ERP project successfulness as well as identify risk factors related to management participation.

Davenport (2000:120) explains that Achieving organizational integration is only achieved when administrative support and strong commitment from those whose commitment counts is visible to all parties involved. Esteves et al. (2002:4) identifies four key dimensions with top management support in the ERP project (Figure 7). All of these dimensions were repeatedly mentioned in the current literature at some form. They are all also tightly linked to management support because management participation is a critical driver in all of these dimensions.

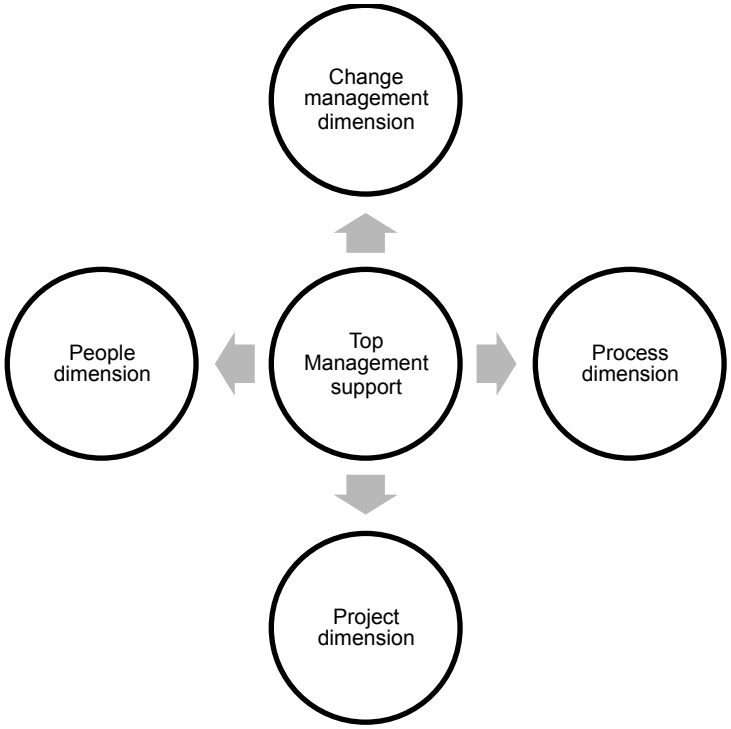

Figure 7: Top management support (Adapted from Esteves et al. 2002:4)

Using Esteves et al. (2002:4) top management support model a coherent picture of management role is discovered. These dimensions could also be seen as the most potential risks in ERP project from the organizational point of view. Hence the understanding of top management support is viewed via these dimensions from the risk factor perspective and aims to learn why they are so critical to the ERP project successfulness to find a way to minimize their risk.

6.2.1 Process management

Davenport (2000:137) defines process as "a way that the work is supposed to be done in an organization". For managers, this means that they need to identify all "works" inside the organization to be able to implement ERP as a part of business process. Without it its impossible to align ERP with business goals set by management (Nah et

al. 2001:291). When ERP project is linked to company's business plan and organizational strategy, goals, and pitfalls of the project are then better understood. Françoise et al. (2009:383) notifies that throughout the project implementation is vital to re-evaluate goals set before and have they achieved. From the risk management perspective, this is critical as the managers see the bigger picture during the process and they have the overall responsibility to see the bigger picture and identify possible deviations from the original plan lined to core business processes. Managers also work in a mediator role between the technology and the organizations their involvement is critical. Process designers and managers need to know what kind of processes the system is capable of supporting and what implications might be born if a configuration is changed (Davenport 2000:130).

Another risk in process management is the lack of management involvement during ERP project. Chen (2001:380) states that management involvement needs to be more than a conception of the project, management needs to show that they are willing to spend time and steer this process forward. They need to be evolved during the whole process. Françoise et al. (2009:383) supports this claim by stating that executives should be made accountable for achieving organizational goals set before as process management commitment has an influence on the personnel's dedication to the project. It is essential that employees see management's commitment and understands it is meaning by engaging in the ERP project by themselves as well.

6.2.2 Change management

Along with top management support change management was often emphasized in ERP project studies. In a nutshell, the purpose of change management is to reduce resistance and influence of negative attitudes among users by preparing them for the introduction of a new system (Kemp and Low 2008:229). When innovation, e.g., ERP system is introduced to a new market in this case employees adaptation process takes time and needs resources. Change management requires organizations to find variables that may impede successful change. Further, the overall culture of the organization must be ready and accepting for the change. When managers' takes into account the culture of the organization and the attitudes towards IT change as a whole, the user will be more capable of facilitating ERP implementation successfully (Schniederjans and Yadav 2013:367). Via an integrated, process-oriented conceptual framework Aladwani (2001:269) interdepends change management. His framework combines typ-

ical marketing concepts to change management strategies and offers an exciting point of view how ERP project may benefit from this kind of mindset (Figure 8).

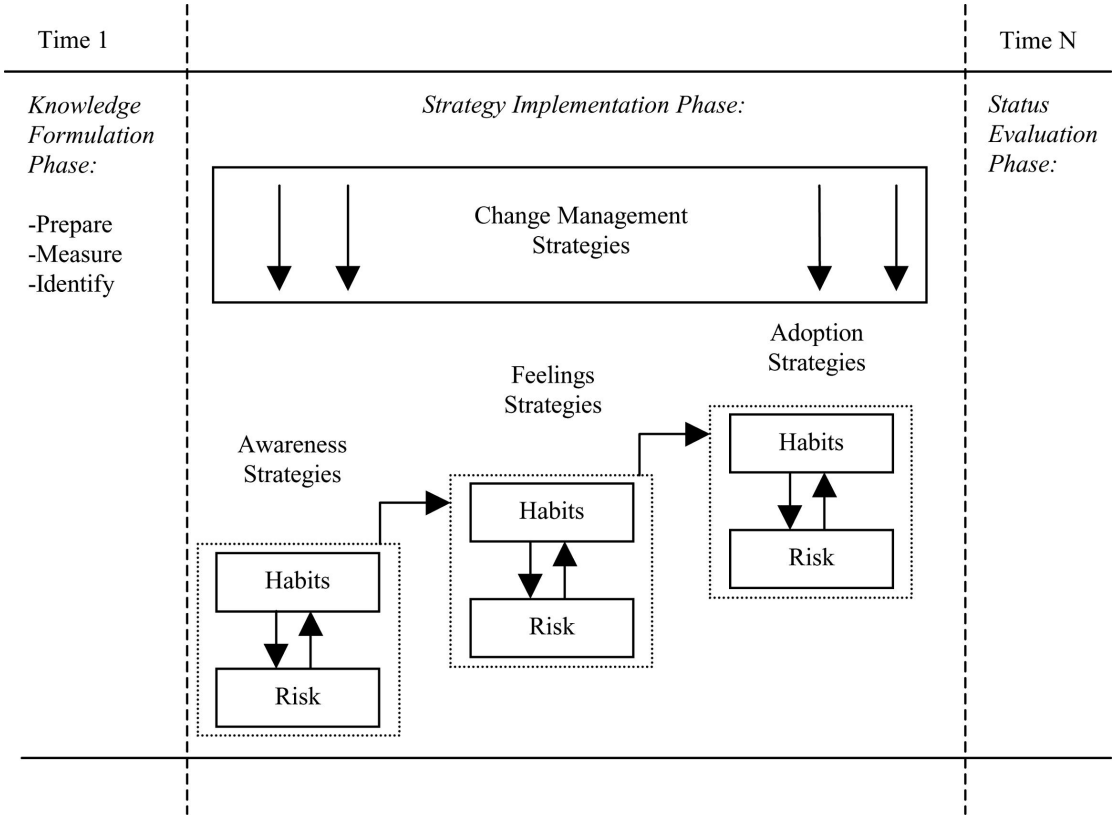

Figure 8: Process-oriented conceptual framework (Aladwani 2001:269)

The first stage in this model is the knowledge formulation phase, where the attitudes of individuals are identified and analyzed (Aladwani, 1998 cited in Aladwani 2001:269). Fundamental questions such as "Who are the resisting individuals? "and "What beliefs and values do they have?" should be asked during this phase to set the starting point and analyze possible changes that need to be addressed in personnel's mindsets (Aladwani 2001:270). Identifying the change leaders, resistors and targets and their mindset as well their readiness will finally help them to adopt new attributes and ease ERP system implementation (Davenport 2000:129). Personnel resistance to changes can form to be one of the most significant risks in the company as the end users input and attitude affect to the overall success of ERP project. Resistance to changes may come from fear of losing a job to new system or feeling of uncertainty to own skill set with the new IT system. Therefore it is critical to find root causes of resistance to address them adequately.

The second stage is strategy implementation phase, where the attitudes discovered in the first stage are tried to change/convinced to adopt upcoming change. Aladwani (2001:270) lists communication to be one of the most helpful tools for managers to affect users attitudes and to inform benefits of ERP. Knowledge about what benefits and how it will affect to the users work routines helps to accept upcoming changes. As the fear of the unknown is a common factor in change management rising awareness in an organization and especially to groups identified in case stage one to be critical to the continuity of ERP project. Also building a positive attitude towards new system is essential; strategies to achieve this goal can be, e.g., cost minimization and training. By cost minimization Aladwani (2001:271) implies to a strategy where an employee is introduced to enhancement possibility of his/her job brought by ERP with a minimal cost (e.g., extra work) this would create a positive adoption attitude to the employee and influence group. Training is also an essential element and natural continuity to introduce users to the system and increase their awareness of unknown. This helps users to adjust to the change and make them feel confident about their capabilities. The last step in the second phase is that individuals and opinion leaders identified in phase one can and should be used to get general endorsement in an organization. One of these ways to achieve this is to convince group leaders to participate implementation process to achieve their commitment and endorsement to the project by nominating them to the key players in the implementation process Aladwani (2001:272). This creates kind of a chain effect where the group leaders will distribute their positive attributes towards ERP inside their groups and this way affect the individual's perception.

The third stage of this framework is status evaluation phase, which refers to a process where management strategies should be evaluated. It is both managers and the employee's benefit to have a clear understanding of the actions taken in change management and their effectiveness to resistance. Aladwani (2001:273) emphasize that useful feedback should be "..timely, accurate and systematic." This feedback offers a possibility to management to notice a missed users that need support and correct their change management strategies and re-apply them to achieve coherent organization towards change. Sooner the evaluation of the change management can be done the better change managers have time to identify risk areas that need to be targeted, e.g., user groups that need to be trained more or negative or false attitudes towards ERP system. As the target of change management is to create a suitable environment in an organization where the change, in this case, ERP project can be implemented, the main risk is that managers do not assess and prepare employees to the change.

From the risk management perspective, the most crucial function which change management plays is the preparation of organization to the upcoming change as well as identifying when the organizational climate is accepting to the change. Thus, change management is most needed at the beginning of ERP project and it has long-lasting consequences that may overwhelm project to negative outcome.

6.2.3 People management

Since technology and information are nowadays available to almost all organization, the resources inside the organization have started to differentiate successful firms from failing ones. Developing internal capabilities to achieve competitive advantage is a critical element in the resource-based view. As achieving competitive advantage is a goal of successful ERP implementation it requires recognition from management to identify best people from the organization and organize them to the implementation team and give them responsibility and free them from other duties to have enough time to handle these changes (Chen 2001:380).

In people management, it is vital to identify employees that lack eligible skills and employees who are unfamiliar with the new process. They need to be appropriately trained and informed of changes. User training was also notified to be one of the most frequently cited CSF in frequency analysis and therefore forming a significant risk for ERP outcome (Davenport 2000:119; Garg and Garg 2013:500) According to Umble and Umble (2002:27) training should be included in the budget and learning process need to be included from the beginning in part of the implementation process without that there is a more significant chance to fail in this process, e.g. by exceeding budget. Schniederjans and Yadav (2013:367) agree to this by stating that user training is vital for enhancing system configuration, which leads to successful implementation. Davenport (2000:130) offers practical examples of different groups that need training; technical people need to learn nature of the system and its characteristics. All users need to learn how to deal with day-to-day routines and how the system can support them in their process. It is also critical to the user to understand how his/her actions affect to the broader organization as ERP connects organization under one system. Even though education and training before implementation are critical, it is also important to keep training and education support available during and after initial implementation phase.

However, education may not guarantee success, because employees also have different mental, physical and emotional capabilities to perform specific tasks better than others. So, it is critical to identify person's natural capabilities before handing them new tasks. Searching and finding a current employee with requires set of skill and knowledge is one of the most challenging tasks in people management in ERP implementation. Knowledge and ability to learn plays a vital role in the success of ERP project, and it also brings competitive advantage if an organization has the ability to learn faster than competitors. Žabjek et al. (2009:598)

6.2.4 Project management

Project management is vital throughout the ERP project, it all begins with a project team selections and creation of timeline how the project should progress. It is also tightly connected to the process management, as the project timeline needs to be in line with business processes. Choosing the correct project team for implementation is essential, as they need to have capabilities to communicate the project to and its progress and dilemmas to the management and users. Communication environment should also be open and feedback should be endorsed (Nah and Delgado 2016:100). When implementation plan and progress are shared throughout the organization, it helps to improve chances to achieve successful ERP implementation (Schniederjans and Yadav 2013:367). It creates better understanding among managers of the issues on ERP implementation giving them an opportunity to make better critical decisions to ensure a positive outcome of ERP implementation Nah et al. (2001:295). Project management team needs to get support from the top management, and the scope of the implementation needs to be defined so that the project management team can notice deviations from the original goal (Nah et al. 2001:292). In case communication does not flow between managers and project team the risks that managers cannot give enough support grows and may even have negative affect to the ERP project outcome.

6.3 Summary of top management support

It was discovered that top management support is needed in several different dimension and it is more than a giving a blessing to the project and overall monitor. Based on the more in-depth investigation it cannot be said that the top management support itself is the most critical variable affecting to the outcome of ERP project as there are several

different dimensions related closely to top management support. There were few continual themes among these dimensions:

- When top management is not involved nor committed to the change over processes required for ERP implementation, it is unlikely that the ERP implementation itself will be successful.
- Needs of the organization and future goals of the organization needs to be identified as well as become conscious of technical aspects of the ERP system. Business strategy need to be aligned with capabilities of software and organizational goals. When these are aligned, the organization can register deviation from the original plan before they create a snowball effect.

- Users are the most significant variable to terminate ERP project success. As their input is directly connected to the behavior and actions taken by management, managers have the keys to the determinate success of ERP project. Therefore, top management support and capabilities to user training and communication between participants in the group in vital.

Also, management commitment in all dimensions and all life stages of ERP system rose in this more in-depth investigation unlike in frequency analysis. It came clear that managers need to commit to ERP project more than a technical solution. As organizations are made up of people, meaning that the way people work needs to be changed same time as the technical solution is introduced to the company and preparation organistion for change takes time Davenport (2000:5). Continuance of management support after implementation was also emphasized. As the business evolves the system needs to evolve with it, training for new employees and updates of the new system adjusting them to fit organization process are depended on the management input (Davenport 2000:132). Real challenge begins after implementation because it requires system maintenance and utilization, data verification and assessing introduction of a software system (Nah et al. 2001:293).

Top management support to different dimension and management commitment are therefore the most significant risk as well as the best opportunities to create positive outcome on ERP project. From the risk management perspective, the most critical aspect of top management support is the manager's capabilities to melt together new technology and business processes as well as employees to achieve desired organiza-

tional goals, as well as to monitor that the original plan does not encounter extensive deviations.

7 Controlling the risk of top management support

Companies have created several different strategies trying to manage risks towards their primary operations. Therefore, it is critical to identify the type of risk in question to examine suitable strategies to control the risk. Kaplan and Mikes (2012), identifies three different risk categories, preventable risks, strategy risks and external risks. Preventable risks rise inside the organization, and therefore they are controllable and can even be avoided. Strategy risks are those that organizations voluntarily accept to generate or enhance current business processes. As the organization willingly accepts the possibility of risks, they cannot be avoided unlike preventable risk, so the risk management strategy needs to be about minimizing the probability of the risk and prepare an organization to manage risk event in case they occur. Last category external risks are created outside of the organization, and they cannot be controlled, these risks are, e.g., political. As they cannot be predicted the risk management strategy needs to focus on identifying these risk possibility and create a risk management strategy in case the risk occurs.

It is clear that the lack of management support concerning the ERP project is a strategically risk since the organization is willing to take the risk that would not exist if a company would not take on a project that would offer an exchange to the business processes and hopefully create advantage. Typical strategic risk management strategies are risk redundancy, risk transfer, and risk minimization. In general, all of the risk management strategies are about enabling organizations to detect problems and handle them before they occur. As the nature of the risk identified in connection to ERP project output is more organization than technological, it needs to be notified that some of the strategic risk management strategies are not applicable to this risk.

Redundancy strategy mostly copes with risks from a technical aspect as the primary ideology is to have a back –up system in case of deviation from normal process occurs, thus giving an opportunity to use backup system to maintain standard business processes (Slack et al, 2013:624). As there cannot be any backup managers to use this

risk management strategy cannot be implied to this risk. Another typical risk management strategy is risk transfer. This strategy can be interpreted in several different ways example partly implementation, shifting responsibilities to third party and timing. Switching responsibilities to a third party referred to transferring the risk to e.g. consultants. Organizations may encounter problems in case they transfer management responsibilities to third party as concultants are not familiar with the organization culture and they do not have existing relationship with the emplyees. For these reasons the risk transfer to third party is not suitable. Risk transfer by a timing is the most practical strategy. According to the change management, the organizational atmosphere needs to be receipted for a change. External environment also needs to be ready for the upcoming changes (Schniederjans and Yadav, 2013:367. Even though the external environment may not be even aware of the changes inside the organization, but it is as well critical that they do not suffer from changes in the organization.

Risk redundancy is one of the most typical methods of coping possible risks when the risk factor is recognized and accepted. Risk reduction strategy focuses on decreasing the scenarios where the negative effects of the risks would occur by, by creating counter measurements that may even eliminate the possible risk or at least reduce it. However, it is impossible to eliminate every possibility of failure in top management support. Thus, it is crucial to create tools to monitor and intervene these risks before they cause bigger issues.

7.1 Goal, Question and Metric approach

To achieve risk redundancy, practical tools need to be taken into action. Esteves et al. (2002) Proposes a Goal, Question, Metric (GQM) tool to monitor and control management support during ERP implementation. Purpose of this plan is to define a set of metrics to monitor top management support in ERP project enabling organizations to reach their desired output on ERP project. GQM framework ideology includes four different phases; planning, definition, data collection, and interpretation (Esteves et al. 2002). Definition phase is the most important step, and it has three steps, define measurement goals, define questions and define metrics (Esteves et al. 2002: 4)

Planning phase includes the overall assessment of the ERP project to ensure the most important phase which prepares for the main component of the GQM tool is to set measurement goals. The tool itself does not offer goals so the organization needs to identify them that would reduce the main risk. Concerning the top management sup-

port, the primary goal could be managers time spent on the support activities. After the goal has been set a main question needs to be identified, it is critical to set the main question that is quantitative, in relation to the goal the question could, e.g. what are the activities that top management should participate. Concerning the main question, some smaller sub-questions needs to be defined for a more practical angle like how many support meetings where done and long they were on average. Finally, metrics related to the sub-questions need the determinate metric to the example sub question can be what the duration of these meeting was. A relationship between goal, question and sub-question is illustrated in figure 9.

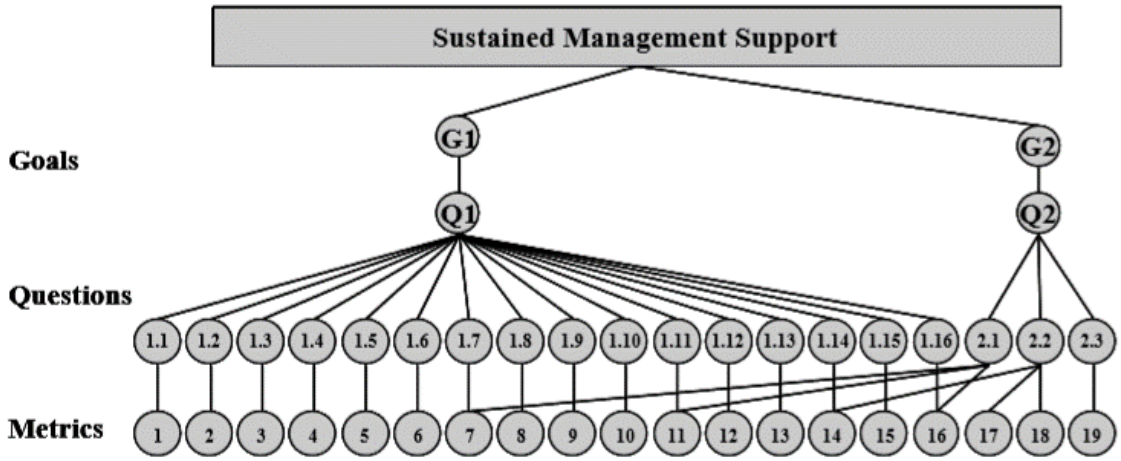

Figure 9: GQM-diagram (Esteves et al. 2002)

After this comes the data collection phase where data is collected according to the sub-questions and their results linked to the proper question. Data collected reveal the status management support during the process. Esteves et al. (2002) did not mention setting targets to the metrics but if targets would be set it would be easy to compare data to previously met targets. For example, in case duration of user training is the metrics and the target metrics amount would be 20 hours and the employee has only accomplished 10 hours, the lack of training can be identified during the implementation project and corrected before it will create problems. Therefore, this GQM tool focuses more on a practical aspect during the ERP implementation then analyzing the output of ERP project.

Albeit Esteves et al. (2002) only introduced GQM framework and did not apply to this actual case studies they still provided few essential factors that encourage real situation tryout. This metrics may have encouraging influence to managers to participate on

implementation project as their activity is measured actively and since their activity is measured deviations from the project plan can be detected before damage occurs (Esteves et al.2002:7).

8 Conclusion

This thesis was conducted by executing an exploratory research using secondary data in an aim to find an answer to the research question: What are the risk factors of ERP project? To achieve answer, objective what is the meaning of ERP system to the organization of this thesis needed to be understood first. Investigating literature discovered that the ERP's meaning of a communication spine to organizations was emphasized and its ability to work as a competitive advantage by two different way. First, by linking business processes to ERP to achieve efficiency and automation, which could generate savings in time and money. Second, to achieve competitive advantage by collecting an organization's shared transactional data from multiple sources, ERP systems eliminate data duplication and provides data integrity with a "single source of truth", creating managers valid information to execute critical decisions.

After receiving a coherent picture of ERP systems meaning to the organization, a search for the risk factors of ERP project begun. First, it was critical to understand how the success of ERP is recognized. No unambiguous way to assess ERP project success was found, since the acquisition reasons and goals of ERP system are strongly depended on the organization and the evaluator's perspective. In general, achieving competitive advantage was discovered to be at even some extent a similar goal for all organization therefore creating mutual metric to assess ERP system implementation in industry wide. Even though a valid standard metrics to assess ERP systems output, was not found literature indicated that the riskiest life stage of ERP project is implementation phase. Pointing that the risks of ERP project are formed in the implementation phase and resources and focus should be especially in the implementation phase.

Assessment methods of ERP systems success revealed that the CSFs are a prominent way to assess risks of ERP project, since the CSFs are crucial for ERP project's success they are risks for the overall outcome. For that reason frequency analysis of CSF instances in literature was conducted. Findings in the frequency analysis showed that change management, user training, project management, top management support and project team are the most discussed topics in the literature. Top management get-

ting most of instances in the literature appearing in almost half of the articles. Even though the ERP system selection did not rose to be most cited CSF, there is no denying of the significant impact. Since it defines several variables later, such as user training and change management which are tightly connected to the selection of the user training. All these factors are management tasks including selection of ERP system. This indicates that the success of ERP implementation strongly depends on the top managers and especially their support to the organization. Thus, main findings of this thesis is that the risk factors of ERP project output are more organizational then technological, and the greatest risk is the lack of top management support.

In a light of the research it can be said that from the literature point of view the top management support have a far greater impact on the ERP project, then another variables. However, it would be unwise to draw firm conclusions on the strength of the results of only literature review. Limitations suspected in the beginning of this thesis were realistic, empirical data of the risk factors in ERP project output was lacking and the practical aspect of the validity of the answers found in the research were not found. Therefore, risk factor identified in this research should be carefully studied via empirical methods.

9 For future research

Literature review in this thesis has proven top management support to be the most critical factor enabling success in ERP project. A natural continuance to this is to try to minimize the risk of top management concerning the negative outcome of ERP project. As this study was conducted by using exploratory research method and secondary data, theories and hypothesis notified in this study has not been tested. This study has justified the meaning of top management support in different dimensions to be relevant to the output of the ERP project. Therefore, it would be desirable that the effect of management support would be empirically tested.

Most importantly, future research should focus on the development of industry standard practical tools how to monitor and evaluate top management's input during. One possible tool to empirically test could the GQM paradigm presented in this thesis. Since this study is not limited to industry or regional area the finding can be applied to any case company.

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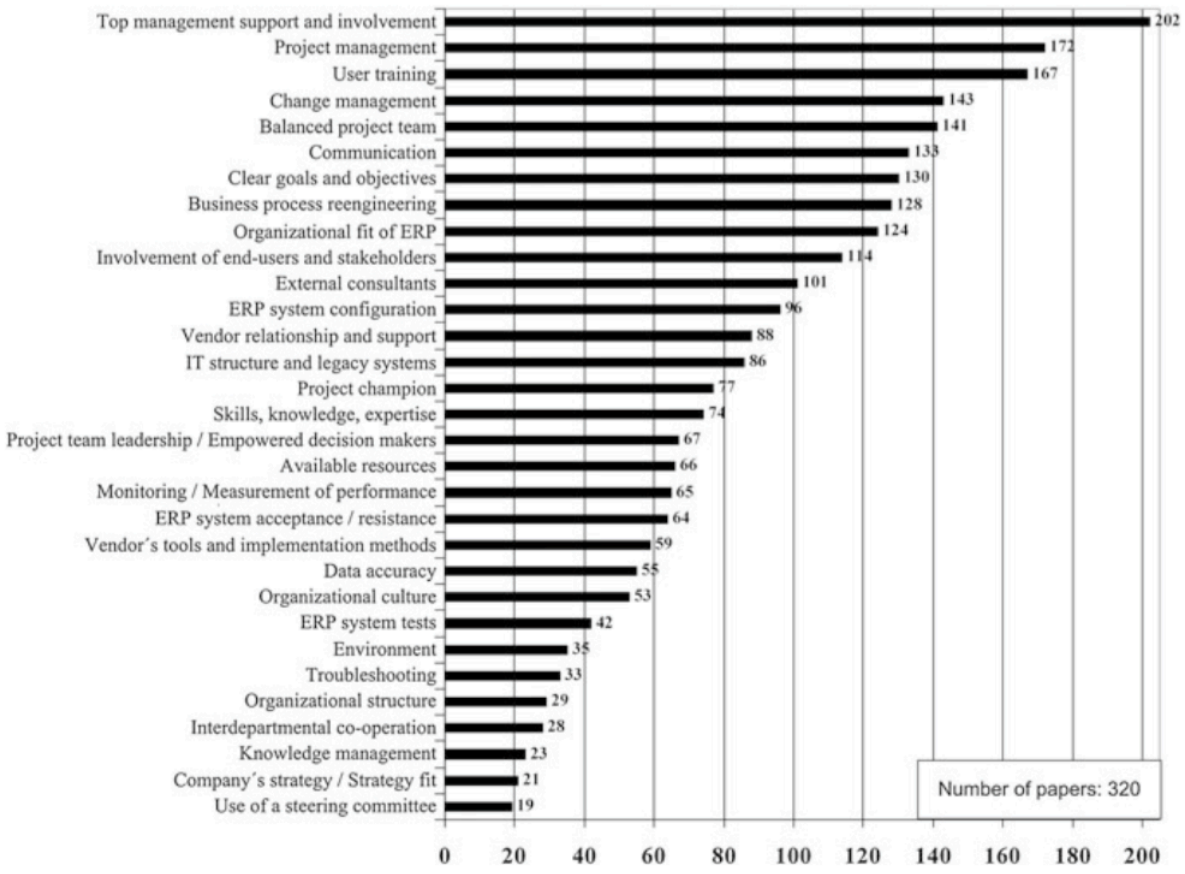
Finney and Corbett (2007) study results

CSF category	Number of instances in literature
Top management commitment and support	25
Change management	25
BPR and software configuration	23
Training and job redesign	23
Project team: the best and brightest	21
Implementation strategy and timeframe	17
Consultant selection and relationship	16
Visioning and planning	15
Balanced team	12
Project champion	10
Communication plan	10
IT infrastructure	8
Managing cultural change	7
Post-implementation evaluation	7
Selection of ERP	7
Team morale and motivation	6
Vanilla ERP	6
Project management	6
Troubleshooting/crises management	6
Legacy system consideration	5
Data conversion and integrity	5
System testing	5
Client consultation	4
Project cost planning and management	4
Build a business case	3
Empowered decision makers	3

Leyh and Crenze (2013) study results

[Number of instances]	Rank	CSFs for ERP system implementations
128	1	Top management support and involvement
104	2	Project management
99	3	User training
86	4	Change management
85	5	Balanced project team
83	6	Clear goals and objectives
78	7	Communication
77	8	Organizational fit of the ERP system
77	8	ERP system configuration
73	10	Business process reengineering
68	11	Involvement of end-users and stakeholders
62	12	External consultants
53	13	Project champion
53	13	IT structure and legacy systems
48	15	Vendor relationship and support
47	16	Skills, knowledge, and expertise
42	17	ERP system acceptance / resistance
41	18	Project team leadership / empowered decision makers
39	19	Vendor's tools and implementation methods
38	20	Monitoring and performance measurement
34	21	Data accuracy
33	22	Available resources
31	23	Organizational culture
23	24	ERP system tests
22	25	Troubleshooting
21	26	Environment
17	27	Organizational structure
16	28	Interdepartmental cooperation
16	28	Company's strategy / strategy fit
15	30	Use of a steering committee
8	31	Knowledge management

Leyh (2016) study results



Zabjek et al. (2009) study results

Critical Success Factor	Number of instances in literature	Rank#
Top management support	20	1
Change management	16	2
Clear Goals and objectives	13	3
User training and education	13	4
Project team organization and competence	13	5
Business process engineering	13	6
Communication	13	7
Project management	11	8
User involvement and participation	10	9
System, technological	10	10
Legacy system management	9	11
Consulting Services	9	12
Sponsorship	7	13
Minimal customization	6	14

Shaul and Tauber (2013) study results

Critical Success Factor	Number of instances in literature	Rank#
Top management support	73	1
Implementation Strategy	71	2
Project management	70	3
Enterprise system	58	4
Project team competence	55	5
Education and training	38	6
Change management	36	7
Vendor	35	8
Enterprise system selection process	31	9
Data management	28	10
Acceptance Control	26	11
Environment	22	12
User Involvement	22	13
Software maintenance	18	14
Organizational experience of major change	12	15

Frequency analysis results

Top 5 CSFs	Finney and Corbett, (2007)	Leyh and Crenze, (2013)	Leyh, (2016)	Zabjek et al., (2009)	Shaul and Tauber, (2013)	TOTAL	Instances in literature % (Total CSF/913)
Top management support	25	128	202	20	73	448	49 %
Change management	25	86	143	16		270	30 %
BPR and software system	23					23	3 %
Project team	21	85	141	13	55	315	35 %
Project management		104	172		70	346	38 %
User training	23	99	167	13		302	33 %
Clear Goals and objectives				13		13	1 %
Implementation Strategy					71	71	8 %
Enterprice system					58	58	6 %
Articles in total	45	185	320	22	341	913	100 %